APPENDIX A - STATISTICAL SAMPLING DESIGN

The proposed approach is to estimate discarded catch separately from retained catch, rather than to estimate total catch directly. Such an approach takes advantage of the comprehensive shoreside monitoring of retained catch and allows focusing the limited observer coverage on situations that will provide the most information about discarded catch. As in all sampling programs, it will be advantageous to subdivide the data into categories that are expected to have different levels of the quantity being measured. For example, the shoreside monitoring of the species composition of the rockfish catch breaks the data into time (quarter), area (port), and gear type. A comparable approach in the observer program is necessary to fully understand discarding patterns. Unfortunately, the limited sampling effort available to implement such an approach leaves gaps in the coverage. An alternative approach is to use broader categories of time and area and to use estimated discard relationships, rather than simple average discard, within each category.

The cumulative vessel limits used to control the rate of catch in the groundfish fishery lead us to expect a discard relationship in which discarding increases as the remaining limit for the species decreases, and increases as the total effort directed at the assemblage containing that species increases (Figure 1). If there was nearly 100% observer coverage, it would be possible to simply calculate a new estimate of discard each time the trip limits used to control the fishery were changed. However, the expected level of observer coverage is much lower (approximately 10-20%), so calculation of average discard within each stratum would be highly variable due to the highly variable discard levels on a tow-by-tow, trip-by-trip, and vessel-by-vessel basis. Therefore, direct estimates of average fleetwide discard levels may not be the best approach, especially when the level of coverage is low.

A feasible alternative is to use the at-sea and shoreside fishery data to calibrate a statistical relationship that can then be used to calculate expected discard levels over a range of conditions. Such an approach was piloted in the first analysis of observer data from the EDCP.

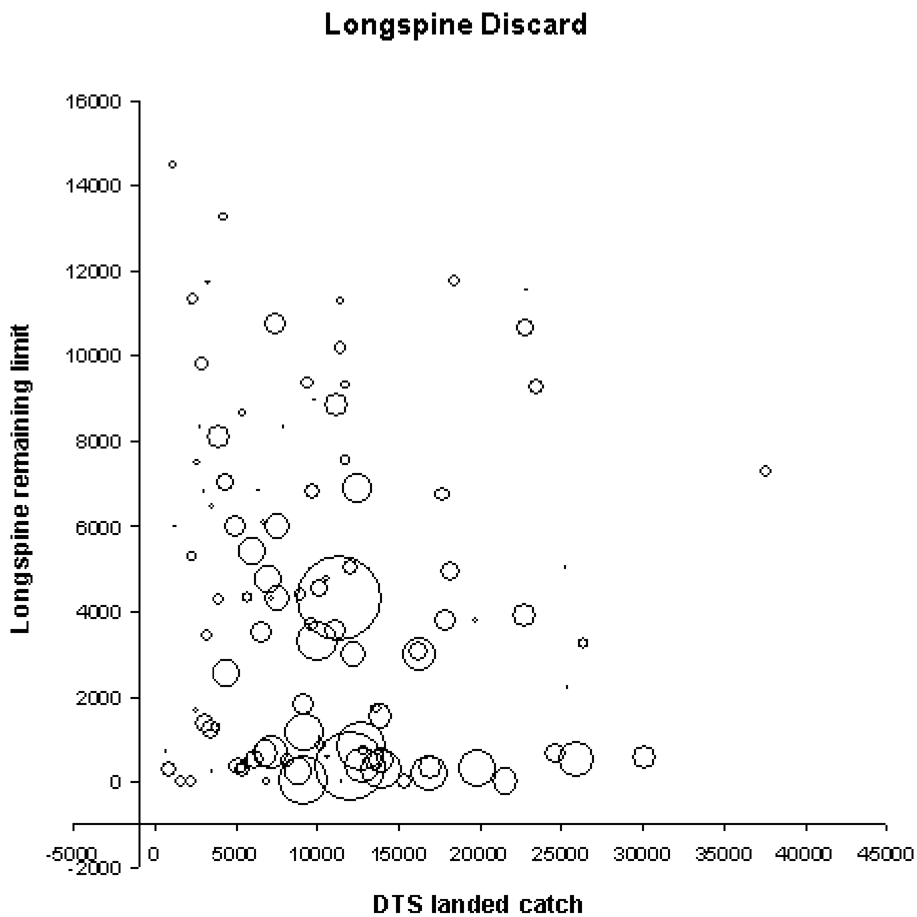

Figure 1 Longspine thornyhead discard(size of bubble) presented in relation to the vessel's remaining limit for longspine at the completion of that trip and in relation to the total landed catch of all DTS species for that trip.

The relationship (model) allows interpolation and some extrapolation of discard information even when limits change, so will provide more timely estimates of discard rates. The discard model can also reduce potential bias in the estimates by adjusting for any non-proportional sampling of trips that are close to cumulative limits. Since landings and remaining limit can be calculated for each trip in the fish ticket database, the predictive model could be used to predict discards for the unobserved trips, thus adjusting for any tendency for the unobserved trips to have a higher or lower occurrence of trips near the cumulative limits.

The key is to collect discard over a wide range of conditions, use these data to calibrate a statistical relationship, then apply this relationship to all fishing effort within the sampled segment of the fishery. Such an approach is tailored to the estimation of discard for trip-limited species. It has also proven useful in the analysis of halibut discard. There it was found that the catch of arrowtooth flounder helped predict the average level of halibut bycatch. Early in the program the statistical relationships will necessarily be simple and it will be necessary to pool information across very broad strata. As data accumulate, it will be possible to improve the estimates by including geographic, seasonal, target species, and other factors in the discard model. Such an approach will also provide flexibility to use alternative sources of bycatch and discard information. Enhanced logbooks for self-reporting of discard and sealed video systems are among the possible methods that could augment the data collected by observers.

Coverage Plan

The level of precision obtained from a given level of coverage depends upon two factors: (1) the number of time, area, and gear categories that have different discard levels; and (2) the level of tow-to-tow and vessel-to-vessel variability in discard within each category. The first factor causes us to need to spread the observer coverage out among all ports and fishing strategies to cover the breadth of potential discard situations. The second factor causes us to need a reasonably high level of coverage within each time, area, gear category. These are conflicting factors and we cannot know how they will balance out until we have accumulated substantial amounts of observer data.

The initial observer deployment will be targeted to achieve a broad level of coverage in the coastwide limited entry trawl fleet and will begin to collect preliminary data from non-trawl sectors, particularly the limited entry fixed gear sablefish fishery and the limited-entry hook&line fishery for rockfish. This plan will build upon earlier observer projects which provide some information on discard by trawlers off Oregon and Washington and will lay the groundwork for coverage of non-trawl sectors. Approximately 75% of the observer effort in the first year will be targeted on the coastwide trawl coverage, and 25% will be used for pilot coverages of the non-trawl sablefish fishery and the hook&line rockfish fishery.

The coverage plan is based upon having approximately 20 observers. It is assumed that these observers will be able to make approximately three trips per month on limited entry trawlers, and that they will be able to make approximately one additional trip per month in a pilot effort on non-trawl and open access gears. In 1999, approximately 200 trawlers made less than

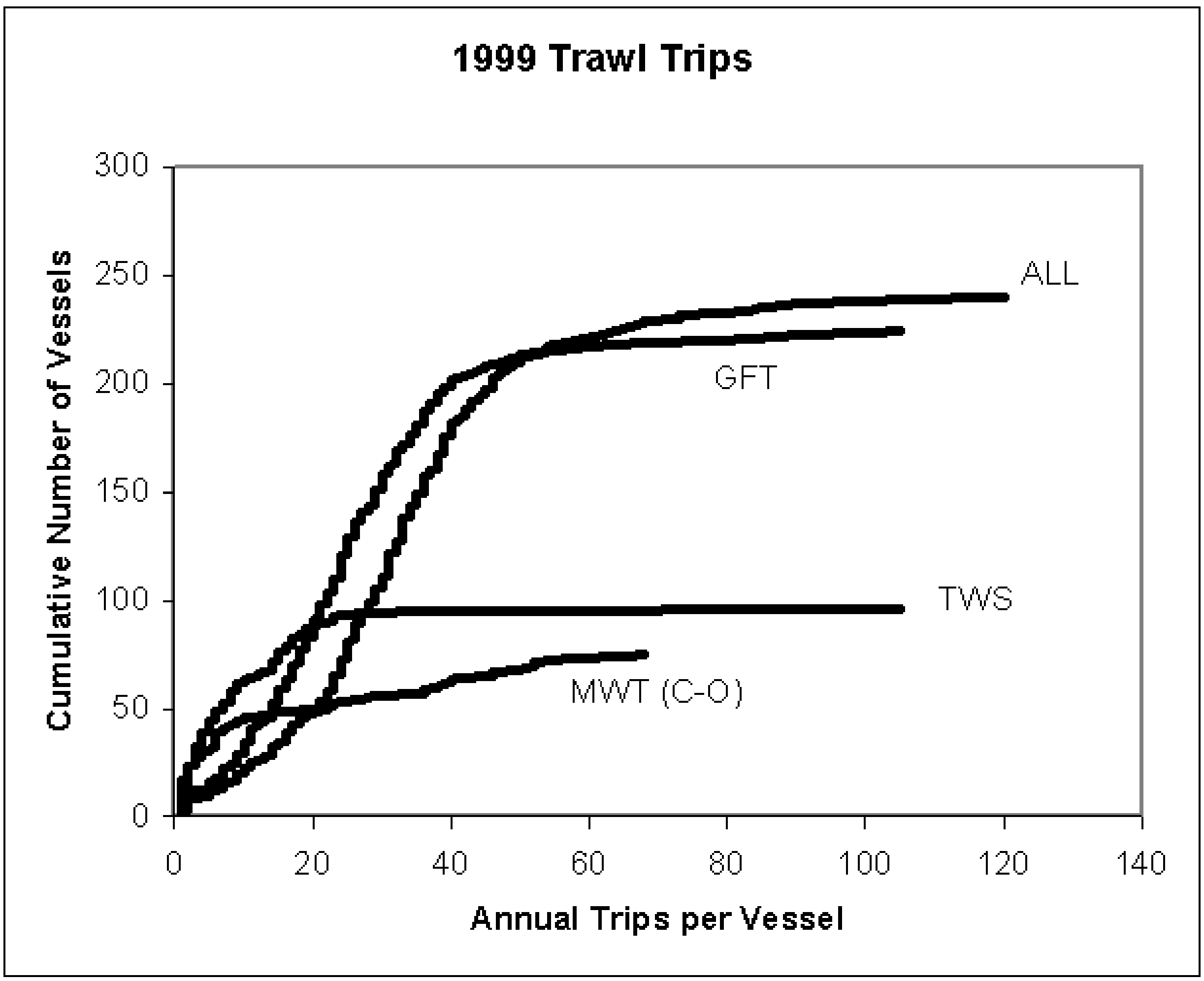

Figure 2 Cumulative distribution of number of trawl trips per vessel in 1999. Shown are the midwater trawl trips in Oregon asnCalifornia (MWT), the shrimp trawl trips by limited entry trawlers (TWS), the groundfish trawl trips (GFT) and all trips.

40 trips in the year (Figure 2). Given the level and coastwide distribution of trawl effort in 1999, it appears feasible to achieve at least a 9% coverage of trawl effort (see Table 1). With reduced levels of fishing activity in 2001, the expected level of coverage will be greater than 9%. With 20 trawl vessels covered at a time and each vessel covered throughout a two month period, it will take approximately two years to cover, on average, all the trawl vessels once.

Table 1. Distribution by port of limited entry trawl trips and non-whiting catch in 1999, and geographic distribution of observers in 2001. The cumulative percentage (CUM. %) for effort and coverage is computed from south to north along the coast.

		TRAWL TRIPS IN 1999		NON-WHITING GROUNDFISH LANDINGS		OBSERVERS		
STATE	LAT-PORT	N TRIPS	CUM. %	MTONS	CUM. %	N	CUM. %	COVER-AGE
CA	344 - SB	113	1%	0	0%		0%	
	344 - VEN	32	2%	2	0%		0%	
	351 - AVL	91	3%	419	1%		0%	
	353 - MRO	130	5%	468	3%	1	5%	10%
	366 - MNT	123	6%	668	4%		5%	
	367 - MOS	172	8%	573	6%		5%	
	369 - CRZ	155	10%	154	7%	1	10%	8%
	370 - PRN	494	16%	748	9%		10%	
	376 - SF	286	20%	831	11%	2	20%	9%
	382 - BDG	109	21%	603	13%		20%	
	394 - BRG	418	27%	2128	19%	1	25%	7%
	408 - ERK	400	32%	1548	23%		25%	
	408 - FLN	354	36%	1270	27%	2	35%	10%
	417 - CRS	660	44%	1644	32%	2	45%	11%
			44%		32%		45%	
OR	422 - BRK	311	48%	1096	35%	1	50%	12%
	433 - COS	957	60%	4320	47%		50%	
	439 - FLR	11	60%	21	47%	2	60%	7%
	448 - NEW	1061	74%	3715	58%	2	70%	7%
	455 - TLL	10	74%	10	58%		70%	
	461 - AST	1388	91%	7884	81%	3	85%	8%
			91%		81%		85%	
WA	463 - LWC	76	92%	558	83%		85%	
	464 - WPT	246	95%	1118	86%	1	90%	11%
	480 - NEA	231	98%	1183	89%		90%	
	480 - PAG	5	98%	12	89%	1	95%	15%
	481 - BLL	113	100%	2975	98%		95%	
	481 - BLN	19	100%	780	100%	1	100%	27%
TOTAL		7971		34747		20		9%